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Monitoring the Quality of Lentik Water in Delingan Reservoir, Karanganyar, Central Java

Monitoring Kualitas Perairan Lentik di Waduk Delingan, Karanganyar, Jawa Tengah

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ABSTRAK

Perairan pedalaman adalah perairan yang terdapat di permukaan tanah dan umumnya terletak di atas permukaan laut. Sebagian besar air di daratan berasal dari air hujan. Perairan pedalaman banyak dimanfaatkan oleh manusia untuk menunjang kelangsungan hidupnya, seperti untuk makan, minum, memasak, mandi, dan irigasi. Penelitian ini bertujuan untuk memantau kualitas perairan lentik di Waduk Delingan serta mengetahui teknik pengambilan sampel dan analisis parameter fisik, kimia, dan biologi perairan lentik. Analisis data yang dilakukan diawali dengan melakukan penelitian di Waduk Delingan Provinsi Jawa Tengah, kemudian hasil yang diperoleh diolah menjadi informasi. Hasil yang diperoleh dari penelitian ini diketahui parameter kualitas air beserta nilainya yang terdiri dari pH, Oksigen terlarut, konduktivitas, salinitas, TDS, kekeruhan, kedalaman, dan potensial oksidasi-reduksi pada empat koordinat yang berbeda.

Kata Kunci: *Air, Kualitas Air, Pemantauan.*

ABSTRACT

Inland waters are waters that are found on the surface of the land and are generally located above sea level. Most of the water on the land comes from rainwater. Inland waters are widely used by humans to support their survival, such as for eating, drinking, cooking, bathing, and irrigation. This study aims to monitor the quality of lentic waters in the Delingan Reservoir and to know the sampling technique and analysis of physical parameters, chemistry, and biology of lentic waters. The data analysis performed was beginning with conducting research in the Delingan Reservoir, Java Province Center, then the results obtained are processed into information. The results obtained from this study are known water quality parameters and their values consisting of pH, Dissolved oxygen, conductivity, salinity, TDS, turbidity, depth, and oxidation-reduction potential at four different coordinates.

Keywords: Monitoring, Quality Water, Water.

INTRODUCTION

Indonesia is the largest archipelagic country in the world and is well known as a maritime country that has many valuable sea resources high economy also has its own charm for humans because of its beauty. According to Sukadi (in Kartamihardja *et al*., 2008) public waters in Indonesia's mainland has an area of approximately 13.85 million hectares consisting of 12.0 million hectares of river and flood exposure, 1.8 million hectares of natural lakes, and 0.05 million hectares of artificial lakes or reservoirs. Water resources and land resources are resource that is very important for the development of the economy of a region (Liu, *et al*., 2018).

Limnology (from English: limnology, from Greek: lymne, "lake", and logos, "knowledge") has equivalents for inland aquatic biology, especially fresh water. On the other hand, inland waters have a high relevance with an area that functions as a water supplier or better known as DAS (watershed), and influences anthropogenic activities in the DAS each inland water is also included in the study of the limnology branch

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(Mulyana, 2020). The ecosystem is an ecological system consisting of components that interact with each other so as to form a unit (Soliha, *et al*.,2016). Freshwater ecosystems are relatively small aquatic ecosystems in advanced earth when compared to land and ocean ecosystems, the division of ecosystems. Fresh water is divided into 2 namely smooth waters or calm waters for example lakes, swamps, and reservoirs as well as lotic waters or waters that have currents such as rivers (Rafi'i, *et al*., 2018).

Aquatic ecosystems consist of various components, both abiotic and abiotic components, and biotic components, one of the components is the microbes that form biofilm and from here it is known if the physics and chemistry of the biofilm matrix will essential to support existing microbial activity in order to understand intact about ecology and its benefits in human life because it is not all regions have the same environmental factors (Kurniawan, et al., 2019). Mainland waters are a stretch of territorial waters located in the land (terrestrial) from the lowest ebb point to the top of the mountain, which generally in the form of river estuaries (estuaries), mangrove swamps, rivers, lakes, swamps, and other artificial bodies of water (reservoirs) (Work Unit of the Directorate of Conservation and Marine National Parks, 2008).

According to Chen (in Abdelmalik, 2018), water quality is a factor in the environment and is very important because it affects people and activities in their economy. Currently increasing the intake of nutrients from all activities anthropogenic in aquatic systems or aquatic waters is very threatening to water quality in the world (Sulastri, *et al*., 2019). Very cyanobacterial growth is dangerous in the waters because it can cause serious problems with water use for domestic, industrial, and agricultural purposes thus endangering the safety of humans and animals (Yongeun, *et al*., 2017). Concerns also arise after the fact was discovered that microplastics in the waters have a bad impact on aquatic organisms because aquatic animals can ingest microplastics can choke and starve due to contracting pseudo-satiety (Zhang, 2018).

The approach uses remote sensing to measure inland water quality dates back 50 years, and hundreds of publications have been published demonstrating a promising remote sensing model for predict the biological, chemical, and physical properties of water bodies at a given depth (Topp, *et al*., 2019).

Water quality is generally monitored using parameters physical or chemical, but recently monitoring with more biota parameters prioritized because it is considered that biota is more assertive in expressing damage, this is because the biota is in direct contact with the river in the same period of time long time, while the physical and chemical properties are more likely to inform the condition of the river at the time the measurement was carried out (Dwirastina & Ditya, 2018). Observation of water quality can be done through the parameters of clarity, depth, temperature, dissolved oxygen (dissolved oxygen or DO), nitrate-nitrogen content, and existing orthophosphate (Dwirastina & Ditya, 2018). Quality standards related to practicum events 10 are a reflection of PP No. 22 Year 2021.

METHODS

This research was conducted in the Delingan Reservoir, Karanganyar Regency, Central Java Province on May 1 2023 at 13.00 WIB. This research was conducted with visit the Delingan Reservoir directly to make observations and collect data. The tools used during this research were pen, paper, boardwalk, and a multiparameter horriba. The materials used are the tally sheets and the waters of the Delingan Reservoir. How it works is the tools and materials are prepared first, then the multiparameter horriba calibrated, then the parameters of inland waters are measured, then the number is calculated, then the results of measurements and calculations are recorded so that they can be completed.

This study uses quantitative and descriptive data analysis, each existing data is processed in a table and then explained. The data analysis performed was starting with conducting research in the Delingan Reservoir then the results obtained are processed into information. Besides that, a search was also carried out through secondary data for the completeness of the report. The last thing to do is an interpretation of the results of the analysis to draw conclusions from the research

that has been done. The method used should be accompanied by references; the relevant modification should be explained. A literature review article should emphasize the procedure and data analysis technique. The stages and analysis of the research must be explained in detail.

RESULTS AND DISCUSSION

Inland waters are waters that are found on the surface of the land and are generally located above sea level. In addition, inland waters flow from a higher place to a lower place. Inland waters can liquid form, namely water as well as solid objects such as ice and snow. Most of the water on the land comes from rainwater. Inland waters are widely used by humans to support their survival, such as for eating, drinking, cooking, bathing, and irrigation. Influencing factors in the amount of water on land apart from the factor of rainfall that falls to earth is vegetation cover on the earth's surface, degree of permeability, and topography.

Inland waters are divided into two types, namely lotic waters flowing or having currents and tapering waters (stagnant waters). or no current. Lotic waters have the characteristics of having currents, exchange between surface and bottom water is more intensive, oxygen levels higher, and the temperature in the water is more evenly distributed. Examples of lotic waters are rivers and ditches. Meanwhile, lentic waters have characteristics that do not have currents, the organisms in it do not really need special adaptations, there is a temperature stratification, the basic substrate is in the form of fine mud, the residence time is relatively longer, and dissolved oxygen levels are not too large because of the current be calm. Examples of tapering waters are lakes, reservoirs, and ponds.

The water sampling method is a method of taking a small amount of water used as sampling in research on materials, substances contained, and types of water to be studied. The purpose of the water sampling method is to determine the water quality of an area such as a river, reservoir, ditch, or lake by measuring the water discharge and testing the in situ parameters (consisting of pH, TDS, electrical conductivity, temperature, and DO). As for the measurement of the tool in water parameters, there is a thermometer to measure temperature waters, DO meter to measure dissolved oxygen levels in waters, refractometer to measure water salinity levels, TDS meter to measure the amount of dissolved solids in the waters, a pH meter to test the acidity of the waters, Secchi disk for measuring turbidity and translucency, and horriba multiparameter for measuring pH (horriba multiparameter neutral pH is number 4.0), temperature, conductivity, DO, turbidity, depth, current velocity, and TDS in one tool at a time because it has multiple sensors.

Water quality is a major determining factor in aquatic ecosystems in a place. Poor water quality can have an impact on the ecosystem in a body of water and its surroundings which could cause death or destruction of an aquatic ecosystem. Water physics factors that influence the difference between aquatic ecosystems with other waters are light and turbidity, temperature, and depth. In this research water sampling method was carried out to obtain and determine the pH, DO, conductivity, salinity, TDS, turbidity, depth, and oxidation-reduction potential (O-RP) in the Delingan Reservoir.

Table 1. Results of measurements of water parameters

Coordinate	pH	DO (mg/L)	Conductivity (mS/cm)	Salinity (ppt)	TDS (g/L)	Turbidity (NTU)	Depth (m)	O-RP (ORPmV)
-7.5877427, 110.9880797	3.43	8.51	0.347	0.16	0.226	53.6	0.5	263
-7.5872445, 110.9879040	4.86	3.45	0.351	0.17	0.228	36.8	1.7	228
-7.5870086, 110.9880820	5.31	3.30	0.351	0.17	0.228	38.8	0.8	205
-7.5870970, 110.9881360	5.27	7.18	0.351	0.17	0.228	40.4	0.55	207

The increase in the content of suspended solids causes turbidity that interferes with and inhibits the penetration of light from outside into the waters. This is very dangerous for the growth of aquatic animals such as because it can cover the gills so that it interferes with the breathing process, besides that, it also inhibits the photosynthesis process needed by chlorophyll to make food in the water. In addition, turbidity can also affect water fertility because the lower the turbidity value, the lower it is also the productivity value of the water. The level of turbidity in the water depends on the material or ingredients contained in the water and usually turbidity like this is influenced by plankton, microorganisms, detritus, sand, and too much mud.

Temperature is a physical factor that also has a significant influence because the deeper the water, the temperature will be owned cold. This happens because of the lack or difficulty of the intensity of the sun in penetrate the waters. Indirectly, the temperature can also affect reduced plankton because the temperature decreases and the density of water increases with increasing depth. Apart from that, temperature too related to oxygen because oxygen is a limiting factor in biota waters. The next factor is depth which also has a share of factors in water physics. This is because depth affects the organisms that exist in aquatic ecosystems because sunlight can only reach up to several meters under the water. If the waters are too deep then sunlight would not be able to penetrate inside and also allow for the existence of a yang species living on the bottom of the water but not contaminated with the sun.

The next factor is the water chemistry factor which consists of degrees of acidity (pH), dissolved oxygen (DO), and carbon dioxide. Water has the ability to resist changes in pH. Just a little bit the pH in the water changes then there will be a signal or hint of natural pH as it can cause changes and imbalances in CO2 levels that are harmful to biota in an area waters because not all living things can survive or adapt to certain pH. High and low levels of pH are affected by the content of oxygen and carbon dioxide. Meanwhile, dissolved oxygen is also needed by organisms in the waters, because they have a role in the process of absorption of food by living things in the waters. If dissolved oxygen is reduced it will interfere with the process of respiration and decomposition of organic matter into inorganic substances.

The final chemical factor is carbon dioxide. Carbon dioxide contained in the water comes from the air through the diffusion process. Besides being used for photosynthesis, carbon dioxide in the waters is also used for the formation of marine animal skins. The last factor is the biotic factors of the waters consisting of plankton and benthos. Plankton is divided into two types, namely phytoplankton and zooplankton. Plankton is very important in the waters, for example, phytoplankton plays a role in primary productivity as well as being an indicator of fertility in the waters. While benthos acts as an indicator to assess water quality, this is because the benthos rarely move places and are relatively settled so they can be directly affected if there is a change in water quality in the waters.

The practicum conducted at the Delingan Reservoir is practicum tapering waters that do not have currents or pools. The location point in the manual in research at the Delingan Reservoir is placed at 4 points with different coordinates. This is to find out the types and differences of the sample in the waters as well as in order to obtain samples that are representative of or representative so that it can fulfill the objectives that have been set. Quality standards turbidity according to (Anonymous, 2008) is 25 NTU for fisheries purposes and recreation. The first point is located at coordinates -7.5877427 and 110.9880797 and has a pH of 3.43, DO of 8.51 mg/L, a conductivity of 0.347 mS/cm, salinity 0.16 ppt, TDS 0.226 g/L, turbidity 53.6 NTU, depth 0.50 m, and oxidation-reduction potential of 263 ORPmV.

The second point located at the coordinates -7.5872445 and 110.9879040 have pH 4.86, DO 3.45 mg/L, conductivity 0.351 mS/cm, salinity 0.17 ppt, TDS 0.228 g/L, turbidity 36.8 NTU, depth 1.70m, and an oxidation-reduction potential of 228 ORPmV. The third point which lies at coordinates -7.5870086 and 110.9880820 have a pH of 5.31, DO 3.30 mg/L, conductivity 0.351 mS/cm, salinity 0.17 ppt, TDS 0.228 g/L, turbidity 38.8 NTU, depth of 0.80 m, and an oxidation-

reduction potential of 205 ORPmV. Last point or the fourth point is located at coordinates -7.5870970, 110.9881360 with a pH 5.27, DO 7.18 mg/L, conductivity 0.351 mS/cm, salinity 0.17 ppt, TDS 0.228 g/L, turbidity of 40.4 NTU, depth of 0.55, and oxidation-reduction potential of 207 ORPmV.

CONCLUSION

From the practicum that can be done, it can be seen that inland waters are waters that are found on the surface of the land and are generally located higher than sea level and are divided into 2 namely lotic waters and lentic waters. The influencing factors are physical, chemical, and biological. From the practicum that has been carried out at the Delingan Reservoir which is lentic waters can be known if water has differences in the values of pH, DO, conductivity, salinity, TDS, turbidity, depth, and oxidation-reduction potential depending on where the water sample was taken. Method monitoring of this research is to conduct research in the Delingan reservoir by taking samples with a thermometer, DO meter, refractometer, TDS meter, pH meter, Secchi disk, and multiparameter Horriba.

Author declaration

Author contributions and responsibilities

The authors made major contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.

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Availability of data and materials

All data is available from the author.

Competing Interests

The authors declare no competing interests.

REFERENCES

Abdelmalik, K. W. 2018. Role of Statistical Remote Sensing for Inland Water Quality Parameters Prediction. The Egyptian Journal of Remote Sensing and Space Sciences. 21 : 193-200.

Dwirastina, M., dan Y. C. Ditya. 2018. Penilaian Kualitas Perairan Ditinjau dari Keanekaragaman Infauna di Sungai Kumbe, Papua. LIMNOTEK Perairan Darat Tropis di Indonesia. 25 (2) : 30-38.

Kartamihardja, E. S., K. Purnomo, dan C. Umar. 2008. Sumber Daya Ikan Perairan Umum Daratan Di Indonesia-Terabaikan. Jurnal Kebijakan Perikanan Indonesia. 1 (1) : 1-15.

Kurniawan, A., M. Musa, L. N. Salamah, T. Yamamoto, A. A. Prihanto, dan A. A. Amin. 2019. Analysis of Physicochemical Properties of Natural Biofilm Matrices Formed in a Sub-Tropical Region (Lake Biwa, Japan) and a Tropical Region (Karangkates Reservoir, Indonesia). AACL Bioflux. 12 (5). 1951.

Liu, D., C. Liu, Q. Fu, M. Li, M. A. Faiz, M. I. Khan, T. Li, and S. Cui. 2018. Construction and Application of a Refined Index for Measuring the Regional Matching Characteristics Between Water and Land Resources. Ecological Indicators. 91 : 203-211.

Mulyana, S. 2020. Kajian Pemanfaatan Koleksi Perpustakaan Pada Pegawai Pusat Penelitian Limnologi LIPI. LIBRIA. 12 (1) : 15-26.

Pancawati, D. K., D. Suprapto, dan P. W. Purnomo. 2014. Karakteristik Fisika Kimia Perairan Habitat Bivalvia di Sungai Wiso Jepara. Journal of Maquares. 3 (4) : 141-146.

Park, Y., J. Pyo, Y. S. Kwon, Y. Cha, H. Lee, T. Kang, and K. W. Cho. 2017. Evaluating Physico-Chemical Influences on Cyanobacterial Blooms Using Hyperspectral Image in Inland Water, Korea. Water Research. 126 : 319- 328.

Purnamasari, I., Kurniawan, dan S. Adibrata. 2018. Pengaruh Kondisi Fisika Kimia Sungai Salim Terhadap Kelimpahan Ikan di Tunatunu Pangkalpinang. Jurnal Borneo Saintek. 1 (3) : 79-91.

Rafi'i, M., dan F. Maulana. 2018. Jenis, Keanekaragaman dan Kemelimpahan Makrozoobentos di Sungai Wangi Desa Banua Rantau Kecamatan Banua Lawas. Jurnal Pendidikan Hayati. 4 (2) : 94-101.

Rukminasari, N., Nadiarti, dan K. Awaluddin. 2014. Pengaruh Derajat Keasaman (pH) Air Laut Terhadap Konsentrasi Kalsium dan Laju Pertumbuhan Halimeda Sp. Jurnal Ilmu Kelautan dan Perikanan. 24 (1) : 28-34.

Satuan Kerja Direktorat Konservasi dan Taman Nasional Laut. 2008. Kebijakan dan Strategi Konservasi Sumberdaya Ikan dan Lingkungannya di Perairan Daratan. Jakarta : Direktorat Jenderal Kelautan, Pesisir, dan Pulau-Pulau Kecil Departemen Kelautan dan Perikanan.

Soliha, E., S. Y. S. Rahayu, dan Triastinurmiatiningsih. 2016. Kualitas Air

dan Keanekaragaman Plankton di Danau Cikaret, Cibinong, Bogor. Ekologia. 16 (2) : 1-10.

Suhendar, D. T., S. I. Sachoemar, dan A. B. Zaidy. 2020. Hubungan Kekeruhan Terhadap Materi Partikulat Tersuspensi (MPT) dan Kekeruhan Terhadap Klorofil dalam Tambak Udang. Journal of Fisheries and Marine Research. 4 (3) : 332-338.

Sulastri, C. Henny, dan S. Nomosatryo. 2019. Keanekaragaman Fitoplankton dan Status Trofik Perairan Danau Maninjau di Sumatera Barat, Indonesia. Prosiding Seminar Nasional Mayarakat Biodiversitas Indonesia. 5 (2) : 242-250.

Susana, T. 1988. Karbon Dioksida. Jurnal Oseana. 13 (1) : 1-11. Topp, S. N., T. M. Pavelsky, D. Jensen, M. Simard, and M. R. V. Ross. 2019. Research Trends in the Use of Remote Sensing for Inland Water Quality Science: Moving Towards Multidisciplinary Applications. Water MDPI. 12 (169) : 1-34.

Zhang, K., H. Shi, J. Peng, Y. Wang, X. Xiong, C. Wu, and P. K. S. Lam. 2018. Microplastic Pollution in China's Inland Water System : A Review of Findings, Methods, Characteristics, Effects, and Management. Science of the Total Environment. 630 : 1641-1653.